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(54) Title: HYGIENE PRODUCTS CONTAINING ODOR NEUTRALIZING AGENTS

(57) Abstract

The present invention provides hygiene products such as toilet tissue, paper towels and wet wipes which have deodorizing properties conferred by the addition of an odor neutralizing agent.

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HYGIENE PRODUCTS CONTAINING ODOR NEUTRALIZING AGENTS

FIELD OF THE INVENTION

The invention relates to improvement hygiene products made of nonwoven web material having deodorizing properties.

BACKGROUND OF THE INVENTION

Hygiene products are used to clean surfaces on the human body, animal body and other surfaces. While traditional products are useful for removing soil and liquid from surfaces, residual soil on the surfaces can cause unpleasant odors. Even a minute amount of malodorous material can cause noticeable odor due to its volatile nature.

Deodorizing effects can be achieved through odor neutralization, odor masking and antimicrobial treatment. Known deodorizing products are generally used separately from cleaning steps.

Personal care products may include additives which confer desired properties. For example, sodium bicarbonate, citric acid and sodium aluminum silicate are additives which have been used to deodorize personal care products after bodily fluids are deposited thereon.

For example, some feminine hygiene products such as liners and maxi-pads have been manufactured to include deodorizing agents in their absorbent core. U.S. Patent No. 5,037,412 issued October 27, 1989. In another feminine hygiene product a deodorant powder was introduced into a sanitary napkin by encapsulating the powder in a crosslinked

polymeric film. U.S. Patent No. 5,230,958 issued July 27, 1993. Incontinence pads have also been manufactured to include sodium bicarbonate within the pad for its deodorizing properties. The sodium bicarbonate is placed in a position to remain dry, rather than to absorb human exudate, thereby deoderizing the pad. U.S. Serial No. 5,342,333, issued August 30, 1994. All of these products provide deodorization of the product after body fluids are deposited and have penetrated through layers of the product. Products which deodorize cleaned surfaces, such as the surface of perinatal region, have not, heretofore, been available.

Hygiene products such as toilet tissue, wet wipes, and scrubs are also manufactured to include special additives which are meant to confer physical properties to the web material beyond the typical properties of the web material alone. For example, lotion has been added to toilet tissue to provide tissue which is more gentle and soft to the skin during use. Durability of the tissue is enhanced by the addition of additives such as wet strength resins which impart additional durability to the web when wet. Surfactants are used to enhance the absorbing characteristics of the paper.

However, odor neutralizing agents to deodorize the cleaned surface have not, heretofore, been added to hygiene products.

SUMMARY OF THE INVENTION

In accordance with the present invention is provided hygiene products having deodorizing properties. The hygiene products of the present invention comprise nonwoven web material and at least one odor neutralizing agent. In preferred embodiments of the present invention, sodium bicarbonate is added to at least one outer face of the web material.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides improved hygiene products having cleaning and deodorizing functions. The hygiene products of the present invention comprise a nonwoven web material including, but not limited to tissue, paper towel, sponge, carded web, air lay web etc. The basis weight of the web material is limited only by limitation imposed by the intended use of the product. For most personal care purposes, the basis weight of web is in the range of from about 5#/R to about 200#/R. In preferred embodiments of the present invention the basis weight is from about 9#/R to about 100#/R.

Since it is typical that offensive odors are caused by acids, odor neutralizing agents applied to these acids act to eliminate malodors. Useful odor neutralizing agents of the present invention are safe and non-irritating to the human skin. Preferably, the selected odor neutralizing agent or agents are also low in cost. Acetic acid, citric acid, sodium bicarbonate and antimicrobial agents such as Triclosan are examples of odor neutralizing agents which may be used alone or in combination in some embodiments of the present invention. In preferred embodiments of the present invention the odor neutralizing agent is sodium bicarbonate.

Surprisingly, only a small amount of odor neutralizing agent is needed to confer deodorizing properties to the web material. It has been found that as little as 0.01mg/in^2 neutralizing agent will confer deodorizing properties to the web. While not wishing to be bound by theory, it is believed that, in some embodiments of the present invention, surprisingly efficient odor neutralization is achieved because the surface area exposed to the malodor is maximized. In preferred embodiments of the present invention the amount of odor neutralizing agent present on the web is 0.1% to 10% (w/w). In still preferred embodiments of the present invention the amount of odor neutralizing agent present on the web is 0.5% to 5% (w/w).

Of course, the ideal amount of odor neutralizing agent depends upon the application and the odor neutralizing agent or agents chosen. For example, it may be useful to include from about 1% to about 10% (w/w) of acetic acid or citric acid while optimal quantities of antimicrobial agent may be slightly less, in the range of about 0.1% to about 5% (w/w). A useful amount of sodium bicarbonate may, for some applications, be from about 0.5% to about 15% (w/w).

Generally, the web is in the form of a sheet, the sheet, having two opposite faces or surfaces. The odor neutralizing agent may be added on one or both faces of the web and may also be distributed within the interstices of the web. Furthermore, where the web is formed in multiple ply, the odor neutralizing agent may also be placed between the layers. However, in some instances, placing the odor neutralizing agent exclusively within the core of a multi-layer product or within the interstices of the web has been found to provide less effective odor control than when the odor neutralizing agent has been added to the face of the web, especially where the product is dry rather than moist. Thus, in preferred embodiments of the present invention, the odor neutralizing agent is distributed on at least one face of the web. It is believed that this placement provides optimal contact of the odor neutralizing agent with odor causing agents.

Hygiene products of the present invention such as toilet tissue or wet wipes may be prepared by a number of methods known to those skilled in the art.

To prepare dry embodiments of the present invention, the method chosen should minimize the amount of odor neutralizing agent in the interior of the web and optimize the amount of odor neutralizing agent on the face of the web. It surprisingly found that despite the presence of odor neutralizing agent on the face of the web, the presence of effective quantities of odor neutralization agent did not result in a product which was unsuitably

dusty. For moist products the odor neutralizing agent is preferably distributed throughout the structure of the web.

The odor neutralizing agent may be added to the web during formation. For example, the odor neutralizing agent may be added to the pulping system of a paper machine or a solution containing the agent may be sprayed onto the web while the web is being formed and dried on the paper machine.

Alternatively, a solution containing odor neutralizing agent may be applied to the web after it has been formed. For example, a suspension which contains a high concentration of odor neutralizing agent can be applied directly to a wet web. In some embodiments of the present invention the suspension may also cover the web after it has been transferred to packaging containers. Among other things, this will prevent drying of the wet web.

Another method which may be used to prepare hygiene products of the present invention is printing the odor neutralizing agent (in a solution) onto the web using, for example, a gravureroll or flexographic techniques known in the art. In preferred embodiments of the present invention the odor neutralizing agent is coated onto the web using roll coating techniques.

The odor neutralizing agent may also be applied to coat the web as a dry powder. For example, a dry powder may be sprayed, dropped or otherwise applied directly onto the web. Either the web or the powder may be electrically charged. Alternatively, the feeder/spreader may be electrically charged to allow application of dry powder onto the moving web.

Any of these methods can be used to apply the odor neutralizing agent alone, or in combination with other additives or web treatments including, but not limited to lotions, antibacterials, anti-fungals, surfactants, wet-strength resins, softeners or inks.

Example 1

Reverse roll coating

The reverse roll coating apparatus consists of an anilox roll (a roll with an overall cell pattern to pick up the baking soda suspension), a rubber roll used to accept the fluid from the anilox roll and to transfer the fluid suspension to the moving web, and a means to deliver the suspension to the anilox roll. The baking soda suspension consisted of 40% (w/w) sodium bicarbonate, 3% (w/w) Natrosol (hydroxyethyl cellulose), and water. The viscosity was 12,000 cps using a Brookfield viscometer. At a web speed of 700 fpm and a rubber roll speed of 70 fpm running in the opposite direction of the 2-ply 20lb/2880 sq ft paper, baking soda was deposited onto the surface of the paper. The contact length of the paper to the rubber roll was about 1 inch.

Example 2

Spray coating

The dry powder apparatus consists of a fluidized bed container of baking soda and pressurized air, a nozzle to deliver the powder to the moving web, and a shroud to contain and recover the powder. At a web speed of 1500 fpm, baking soda was sprayed onto the surface of the 2-ply 20-lb/2880sq. ft. paper. Quantitative analysis of the baking soda content on the sheet gave a value of 0.54% (w/w).

Example 3

A toilet tissue with surfaces coated with sodium bicarbonate at a 0.5% to 7% (w/w) level is prepared by coating the toilet tissue surfaces with dry sodium bicarbonate powder using a dry powder spray process.

Example 4

A baby wipe product containing sodium bicarbonate and lotion is prepared. The web material is an airlay

material. 0.5% to 9% (w/w) sodium bicarbonate is mixed in a body lotion. The mixture is applied to the web material.

Example 5

A wet wipe product containing acetic acid is prepared. The web material is carded web. 0.5% to 10% (w/w) acetic acid is applied to the web using a spray method. The wet wipe is used to eliminate fish odor at fish preparation stations.

Example 6

A wet wipe product containing sodium bicarbonate and lotion is prepared for use in adult diaper changes. A 10% to 15% (w/w) suspension of sodium bicarbonate in body lotion is applied directly to a base web. The base web is an airlay web.

Example 7

A paper towel product containing sodium bicarbonate and a scent is prepared. A solution of 10% to 15% (w/w) sodium bicarbonate and a selected scent is printed onto the paper towel web in an ornamental design.

Example 8

Simulated urine odor

A solution which simulates urine odor was prepared by combining 50mg phenyl acetic acid, 100μL hexanoic acid and 50μL butanoic acid in a 100mL volumetric flask containing about 70mL of distilled water. The contents was mixed until dissolved, then diluted to the 100mL mark with distilled water and mixed well. This solution contains approximately 2000 ppm of mixed carboxylic acids.

Example 9

Simulated fecal odor

A solution which simulates fecal odor was prepared by combining 75 μL dimethyltrisulfide, 25 μL dimethyldisulfide, and 1.0mL of a solution containing 50mg Skatole and 50mg indole in 10mL methyl alcohol, in a 100 mL volumetric flask containing about 70mL distilled water. The contents was mixed until dissolved, then diluted to the 100mL mark with distilled water and mixed well. This solution contains about 1100 ppm of substances said to comprise significant malodorous components of feces volatiles.

Example 10

Tissue spiking

Neutralization of urine odor

Into two separate 1000mL jars with teflon-lined caps were placed about 1.25 grams of a control tissue or a tissue treated in accordance with Example 2. Tissues were treated to have one of 2 levels of baking soda, 0.5% and 2% (w/w).

1.0mL of a urine odor simulating solution prepared as described in Example 8 was pipetted onto the tissue in the jars and the jars sealed. After 10-15 seconds, the jars were opened and the odor of the contents of each judged by sniffing the contents. A panel of 11 judges evaluated the odor intensity, ranking it on a scale from 0 (no odor) to 7 (high odor). A statistical test of significance was applied to analyze the data. The difference in odor was significant as subtracting the $t_{95}xS_D$ value from the average yields a number that is greater than zero. The panel evaluations were as follows:

Urine Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	2.0% baking soda	Difference	0.5% baking soda	Difference
1	5	0	5	3	2
2	6	1	5	4	2
3	7	1	6	5	2
4	6	0	6	2	4
5	4	1	3	4	0
6	6	0	6	3	3
7	6	1	5	7	-1
8	7	1	6	6	1
9	7	1	6	4	3
10	5	3	2	3	2
11	2	0	2	0	2
Average			4.7		1.8
Std. Dev.			1.6		1.4
$t_{95}*S_D$			0.87		0.76

Example 11

Tissue spiking

Neutralization of simulated fecal odor

Into two separate 1000mL jars with teflon-lined caps were placed about 1.25 grams of a control tissue or a tissue treated in accordance with Example 2 to have about 0.5% (w/w) baking soda.

1.0mL of a fecal odor simulating solution prepared as described in Example 9 was pipetted onto the tissue in the jars and the jars sealed. After 2 minutes, the jars were opened and the odor of the contents of each judged by sniffing the contents. The treated tissue had less odor than the control tissue.

Example 12

Skin wiping simulation

Neutralization of simulated urine odor

Urine odor simulating solution, prepared as described in Example 8, was pipetted onto collagen film in holding rings of 2 inches in diameter. The solution was spread upon the collagen by placing a coverslip over it; after thirty seconds, the coverslip was removed. The solution was then wiped off the collagen using either a control tissue or a tissue treated as described in Example 2 and having one of 2 levels of baking soda, 0.5% and 2.0% (w/w). The residual odor of the collagen surface was judged by sniffing. Two panels of judges, 12 and 10 members large, evaluated the residual odor on a scale from 0 (no odor) to 7 (high odor). A statistical test of significance was applied to analyze the data. The difference in odor was significant as subtracting the $t_{95}xS_D$ value from the average yields a number that is greater than zero. The evaluations of the panels were as follows:

Urine Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	2.0% baking soda	Difference
1	7	4	3
2	5	3	2
3	6	4	2
4	3	0	3
5	6	2	4
6	5	2	3
7	5	3	2
8	4	2	2
9	6	3	3
10	5	3	2
11	6	4	2
12	2	1	1
Average			2.5
Std. Dev.			0.8
$t_{95}*S_D$			0.41

Urine Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	0.5% baking soda	Difference
13	6	4	2
14	5	1	4
15	4	2	2
16	5	3	2
17	4	5	-1
18	5	6	-1
19	7	5	2
20	5	4	1
21	4	2	2
22	4	3	1
Average			1.4
Std. Dev.			1.51
$t_{95}*S_D$			0.875

Example 13

Skin wiping simulation

Neutralization of simulated fecal odor

Fecal odor simulating solution prepared as described in Example 9 was pipetted onto three collagen films in holding rings. The solution was spread upon the collagen by placing a coverslip over it. Ten seconds later, the coverslip was removed using a pair of needle nose tweezers. The solution was then wiped from the collagen using a control tissue or a tissue treated as described in Example 2 and having about 0.5% (w/w) of baking soda. The residual odor of each of the collagen surfaces was judged by sniffing. The residual odor of the treated tissue was less than that of the control tissue.

Example 14

Simulated fish odor

A solution which simulates fish odor, a urine odor problem affecting some people, was prepared by dissolving 400 μL of 25% (w/w) trimethyl amine in distilled water. After mixing the solution, distilled water was added until the total volume reached 100mL. Then, the solution was mixed again.

Example 15

Simulated sweat odor

A solution which simulates sweat odor was prepared by combining 50μL isovaleric acid, 50μL butanoic acid, 50μL valeric acid and 50μL hexanoic acid in distilled water. The solution was mixed and distilled water added until the total volume was 100mL. Then, the solution was mixed again.

Example 16

Tissue spiking

Neutralization of simulated fish odor

Into three separate 1000mL jars with teflon-lined caps were placed about 0.5 grams of a control tissue or a tissue treated in accordance with Example 2 having one of 2 levels of baking soda, 0.5% and 2.0% (w/w).

500μL of a fish odor simulating solution as described in Example 14 was pipetted onto the tissue in the jars and the jars were sealed. After 10-15 seconds, the jars were opened and the odor of the contents of each judged by sniffing the contents. Two panels of judges, 8 and 10 members large, evaluated the intensity of the odor, ranking it on a scale from 0 (no odor) to 7 (high odor). A statistical test of significance was applied to analyze the data. The difference in odor was significant as subtracting the $t_{95}xS_b$ value from the average yields a number that is greater than zero. The panel evaluations were as follows:

Fish Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	2.0% baking soda	Difference
1	5	1	4
2	4	1	3
3	5	1	4
4	6	0	6
5	5	0	5
6	5	0	5
7	5	2	3
8	6	3	3
Average			4.1
Std. Dev.			1.1
$t_{95}*S_D$			0.73

Fish Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	0.5% baking soda	Difference
9	3	1	2
10	6	4	2
11	5	0	5
12	6	0	6
13	3	2	1
14	5	3	2
15	6	0	6
16	7	2	5
17	1	1	0
18	6	0	6
Average			3.5
Std. Dev.			2.32
$t_{95}*S_D$			1.50

Example 17

Tissue spiking

Neutralization of simulated sweat odor

Into three separate 1000mL jars with teflon-lined caps were placed about 0.5 grams of a control tissue or a tissue treated in accordance with Example 2 having one of 2 levels of baking soda, 0.5% and 2.0% (w/w).

500μL of an odor simulating solution prepared as in Example 15 was pipetted onto the tissue in the jars and the jars were sealed. After 10-15 seconds, the jars were opened and the odor of the contents of each judged by sniffing the contents. Two panels of judges, 11 and 10 members large, evaluated the intensity of the odor, ranking it on a scale from 0 (no odor) to 7 (high odor). A statistical test of significance was applied to analyze the data. The difference in odor was significant as subtracting the $t_{95}xS_D$ value from the average yields a number that is greater than zero. The panel evaluations were as follows:

Sweat Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	2.0% baking soda	Difference
1	7	1	6
2	7	3	4
3	6	2	4
4	6	3	3
5	6	3	3
6	4	1	3
7	6	3	3
8	6	5	1
9	5	1	4
10	6	4	2
11	7	4	3
Average			3.4
Std. Dev.			1.3
$t_{95}*S_D$			0.71

Sweat Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	0.5% baking soda	Difference
12	6	3	3
13	4	3	1
14	6	2	4
15	7	3	4
16	7	3	4
17	6	4	2
18	5	2	3
19	7	3	4
20	7	0	7
21	7	3	4
Average			3.6
Std. Dev.			1.6
$t_{95}*S_D$			0.87

Example 18

Skin wiping simulation

Neutralization of simulated sweat odor

Sweat odor simulating solution prepared as described in Example 15 was pipetted onto collagen film in holding rings of 2 inches in diameter. The solution was spread upon the collagen by placing a coverslip over it and after thirty seconds, the coverslip was removed. The solution was then wiped off the collagen using one of a control tissue or a tissue treated as described in Example 2 having one of 2 baking soda levels, 0.5% and 2.0% (w/w). The residual odor of the collagen surface was judged by sniffing. Two panels of judges, each 10 members large, evaluated the residual odor on a scale from 0 (no odor) to 7 (high odor). A statistical test of significance was applied to analyze the data. The difference in odor was significant as subtracting the $t_{95}xS_D$ value from the average yields a

number that is greater than zero. The panel evaluations were as follows:

Sweat Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	2.0% baking soda	Difference
1	7	4	3
2	5	3	2
3	4	1	3
4	5	0	5
5	6	5	1
6	7	5	2
7	5	2	3
8	6	5	1
9	7	4	3
10	6	5	1
Average			2.4
Std. Dev.			1.3
$t_{95}*S_D$			0.75

Sweat Malodor Rating (0-7) 0 = no odor

Panelist	No baking soda	0.5% baking soda	Difference
11	4	5	-1
12	4	2	2
13	4	3	1
14	3	2	1
15	5	2	3
16	6	3	3
17	2	4	-2
18	3	2	1
19	2	2	0
20	5	3	2
Average			1.0
Std. Dev.			1.63
$t_{95}*S_D$			0.945

Example 19

Skin wiping on human skin

Neutralization of simulated urine and sweat odors

The ventral surfaces of both forearms of 12 test subjects were cleaned with non-fragrant soap and water and blotted dry. If necessary, the surfaces were shaved first. Subsequently, the forearms were washed with an alcohol-acetone mixture and air-dried. A disc of paper of 1 5/8 inches in diameter was placed onto the clean area of each forearm.

An odor simulating solution containing 1000 ppm of malodorous components of urine and sweat was prepared as described in Examples 8 and 15. 0.5mL of the solution was dispensed under the disc on each forearm and after 1 minute the disc was removed. One forearm of each test subject, selected at random, was wiped with control tissue, the other

forearm with tissue treated as described in Example 2 having a baking soda content of 1% (w/w).

Three judges independently sniffed both forearm sites on each test subject and recorded the forearm which had the stronger odor. The judges identified the control side 66.7% of the time, rather than 50% of the time, which would be expected had the treated tissue no effect. Applying the traditional hypothesis test, this difference was found to be a significant improvement in malodor reduction when using the treated tissue. The evaluations of all judges were as follows:

Subject	Treatment Arm	Judge Sequence	Judge 1	Judge 2	Judge 3	Percent Correct
1	Right	321	Control	Control	Control	100
2	Left	213	Control	Control	Active	66.7
3	Left	231	Control	Active	Active	33.3
4	Right	123	Active	Control	Control	66.7
5	Left	132	Control	Active	Control	66.7
6	Right	321	Control	Control	Control	100
7	Right	213	Active	Control	Control	66.7
8	Left	231	Active	Control	Control	66.7
9	Left	321	Control	Control	Control	100
10	Right	123	Active	Control	Control	66.7
11	Left	132	Active	Active	Active	0.0
12	Right	312	Active	Control	Control	66.7
Overall			50.0%	75.0%	75.0%	66.7%

Example 20

Skin wiping on human skin

Neutralization of human feces odor

The ventral surfaces of both wrists of 12 test subjects were cleaned with isopropanol saturated swabs and blotted dry. If necessary, the surfaces were shaved first. A site of 1 5/8 inches in diameter was identified on each wrist. Human feces was donated by all test subjects and 0.20 grams were applied evenly to the site on each wrist. After one minute, one wrist of each test subject, selected at random, was wiped with control tissue, the other wrist with tissue treated as described in Example 2 having a baking soda content of 1% (w/w).

Starting with the third test subject, two drops of sterile physiological saline were added to and mixed with the feces on the wrist yielding a thick slurry. This was necessary as the feces tended to dry out, thereby making the removal difficult.

Three judges independently sniffed both wrist sites on each test subject and recorded which wrist had the stronger odor. The judges identified the control side 72.2% of the time, rather than 50% of the time, which would be expected had the treated tissue no effect. Applying the traditional hypothesis test, this difference was found to be a significant improvement in malodor reduction when using the treated tissue. The evaluations of all judges were as follows:

Subject	Treatment Arm	Judge Sequence	Judge 1	Judge 2	Judge 3	Percent Corect
1	Left	213	Control	Control	Control	100
2	Right	123	Active	Control	Active	33.3
3	Right	321	Control	Control	Control	100
4	Left	321	Active	Control	Control	66.7
5	Left	312	Control	Control	Active	66.7
6	Right	213	Control	Control	Active	66.7
7	Right	132	Control	Control	Control	100
8	Left	231	Control	Active	Control	66.7
9	Left	123	Active	Control	Active	33.3
10	Right	312	Control	Control	Active	66.7
11	Right	231	Control	Control	Control	100
12	Left	132	Control	Control	Active	66.7
Overall			75.0%	91.7%	50.0%	72.2%

What is claimed:

1. A hygiene product comprising a nonwoven web and at least one non-irritating odor neutralizing agent.

2. The hygiene product of claim 1 wherein the odor neutralizing agent at least one of sodium bicarbonate, citric acid, acetic acid or an antimicrobial agent.

3. The hygiene product of claim 1 comprising a nonwoven web having two outer faces, wherein the odor neutralizing agent is present on at least one face of the web.

4. The hygiene product of claim 1 wherein the web is moist.

5. The hygiene product of claim 1 wherein the web is dry.

6. A hygiene product comprising a nonwoven web saturated with a solution comprising at least one odor neutralizing agent.

7. A hygiene product comprising a nonwoven web having two outer faces, at least one of which is coated with at least one dry odor neutralizing agent.

8. A hygiene product comprising tissue having two outer faces, at least one of which is coated with from about 0.1% to about 15% (w/w) sodium bicarbonate.

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61F 13/15
US CL :604/360
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 604/359-361, 367, 370, 374

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US, A, 5,161,686 (WEBER ET AL.) 10 November 1992, see column 1 lines 62-66, column 9 lines 59-65, column 10 lines 61-63, and column 12 lines 40-43.	1-7 --- 8
X	US, A, 4,740,398 (BOUCHETTE) 26 April 1988, see column 1 line 60, and column 4 line 6.	1-7
Y	AU, A, 109,904 (MUNZ) 23 February 1939, see column 2 line 24.	8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 22 FEBRUARY 1996	Date of mailing of the international search report 06 MAR 1996
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer FRANCIS K. CUDDIHY Telephone No. (703) 308-2996

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